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ABSTRACT

This paper describes the design of a Web-based learning environment for leadership facilitators in a United States military organization. The overall aim of this project was to design a prototype of an online learning environment that supports leadership facilitators' knowledge development in the content area of motivation. The learning environment was designed to provide new learning opportunities for facilitators to build content knowledge through interactive learning activities and experiences with other members of their own community. This project was managed as a concurrent solution design process incorporating elements of strategic thinking, change creation, work environment design, and rapid prototyping. The front-end analysis and impact evaluation were built into the design process. The use of the iterative solution design process (with the iterative design phases of performance analysis, prototype design, and prototype re-design) allowed for increased efficiency and effectiveness in making ongoing refinements and improvements to the prototype. The project team agreed upon three broad areas of learning environment design--analyzing, designing, and continuously improving--and these principles were used as the foundation for a pre-prototype evaluation plan. The plan included questions derived from a variety of performance improvement theories and models. A solution design decision aid assisted in evaluating the effectiveness of the learning and performance environment. Specific strategies and recommendations related to utilization and ongoing support of the prototype that was designed and delivered to the client were proposed. These focused in two key areas: adopting and diffusing the product within the target organization; and continuously improving the design and usefulness of the current prototype once it has been adopted by the target organization. Critical diffusion and work environment factors are identified, with recommendations, to highlight some of the biggest challenges to project success. Brief descriptions of each major component of the Web-mediated learning and performance environment are then offered, with recommendations for continuous improvement and maintenance of each on the Web site. (AEF)

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Learning System Design Considerations in Creating an Online Learning Environment

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Introduction

This paper describes the design of a web-based learning environment for leadership facilitators in a U.S. military organization. The overall aim of this project was to design a prototype of an online learning environment that supports leadership facilitators' knowledge development in the content area of motivation. This learning environment was designed to provide new learning opportunities for facilitators to build content knowledge through interactive learning activities and experiences with other members of their own community. In order for this learning and performance environment to continually improve and be effective in the long run, issues concerning diffusion of the technology and ongoing learning community development should be addressed.

The iterative design phases used to develop this web-based application are illustrated in Figure 1 below. The processes of analysis, design, and evaluation are often thought of as unique, stand-alone events. This project was managed as a concurrent solution design process incorporating elements of strategic thinking, change creation, work environment design, and rapid prototyping. The front-end analysis and impact evaluation were built into the design process.

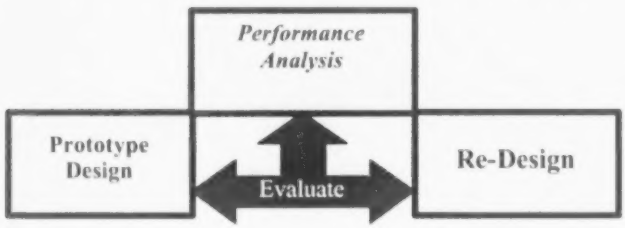

Figure 1. Iterative Design Phases

The use of this iterative solution design process allowed for increased efficiency and effectiveness in making ongoing refinements and improvements to the prototype. The designers utilized the learning environment design principles identified in the next section to drive the major tasks and to assure project quality.

Additionally, actions considered necessary for ongoing support of the web-based environment were summarized in two major areas: 1) Diffusion of the technology into the facilitator community, and 2) Continuous improvement and adaptation of the site by the community.

Key learning environment design principles and concepts

The project team agreed upon three broad areas of learning environment design. These components address a wide array of solution analysis, design, development, implementation, evaluation and diffusion issues. For the sake of brevity, these principles have been listed, but not fully elaborated upon, below. These principles are useful as guides to match project needs with learning environment features.

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Analyzing

- Identify people who are accountable for the results of learners and engage them in the design goal setting process.
- Identify components and levels of the organizational system where performance-based results are dependent on learning achievement.
- Determine measures of success of learning and performance on an individual and organizational basis.
- Plan how you will evaluate this success (pre-post learning).
- Identify non-training, work environment factors that could contribute to the success or failure of the web-based learning environment.
- Create a plan for diffusion and adaptation of the learning environment within the organization.
- Create an awareness and knowledge of the analysis process.

Designing

- Create learning objectives from performance objectives, based on task, job and/or performance analyses.
- Create activities that gain the learners' attention by engaging them in the learning process.
- Create activities that show learners how the instruction will be of benefit to them.
- Provide ways for the learners to practice learning activities and get feedback on their performance.
- Create ways for learners to assess their own performance in a meaningful way that simulates the actual performance as close as possible.
- Create ways for learners to access a common knowledge base of resources on a given topic.
- Provide ways for learners to interact with instructors and with other learners.
- Provide ways for learners to gain multiple perspectives on a particular problem solving approach.
- Provide a means for learners to access knowledge based on previous learners' experiences.
- Engage members of the learning community or organization in adaptation of the learning environment for better fit within the current culture.

Continuously Improving

- Collect data to measure the success of learners and specific learning environment design processes.
- Identify non-training, work environment factors that could contribute to the success or failure of the web-based learning environment.
- Adapt learning design processes / adapt environment to optimize performance of learners.
- Collect data to measure the success of performers and the organization in meeting goals as related to learning activities and objectives.

These key design principles were used as the foundation for a pre-prototype evaluation plan. The plan included questions derived from a variety of performance improvement theories and models. A solution design decision aid assisted in evaluating the effectiveness of the learning and performance environment. Tables 1 through 5 are excerpts of this decision aid.

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Table 1: Strategic Organizational Context (adapted from Ely; Kaufman; Rogers) **Evaluation Probes**
Strategic Linkages
• How are project objectives linked to the job, work center, and organizational missions and vision?
• Has a continuous improvement plan including impact evaluation been completed for this project?
Innovation-Change Adoption
• Is there a primary stakeholder, and owner of this project that will support its adoption and diffusion?
• What are barriers that may prevent long-term or continued success of the project?

Table 2: Organization-Work Center Context (adapted from Gilbert; Wedman & Graham) **Evaluation Probes**
Expectations and Feedback
• Do performers know what is expected of them on the job? Do they know when they have done the job correctly?
Tools and Information
• Will supporting documentation, job aids, and other performance support be available?
• Is there time in the work schedule for performers to use new skills learned in training? (TT)
Rewards and Incentives
• Is completion of tasks rewarded or punished?

Table 3: Performer Context (adapted from Keller; Wedman & Graham) **Evaluation Probes**
Motivation and Self- Concept
• Do workers want to do good work?
• Do they monitor their own performance?
Performance Capacity
• Are workers physically able to complete job tasks?
• What degree of flexibility with respect to work pace, structure, and organization is required of workers?
Skills and Knowledge
• Do workers have adequate knowledge and skills to do the job well?
• Which skills taught in training are not being used on the job? Why aren't they being used? (TT)

Table 4: Instructional Design (adapted from Dick and Carey; Keller) **Evaluation Probes**
Practice/Assessment:
• Does practice seem relevant to on-the-job expectations and performances?
• Do practice items/assessments match objectives?
Feedback:
• Does feedback promote learner satisfaction with the learning experience?
• Does feedback encourage further exploration? How could exploration be further encouraged?
Interactivity:
• If appropriate to objectives, is interaction among learners supported?

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Table 5: User-Computer Interface (adapted from Nielsen) Evaluation Probes
Visibility of system status
• Does the learner know where he/she can/should go next?
Match between system and the real world
• Does the online learning environment represent or support the work environment?
Consistency and standards
• Is there a standard convention used to identify key areas of the site?
Aesthetic and minimalist
• Is information presented progressively from more general to more specific, thus allowing learners to drill down to in-depth information as necessary?

To accomplish the objectives of this particular project, the iterative design phases (performance analysis, prototype design, and prototype re-design) were integrated with the design principles to produce a functional prototype. A review of this integration process and recommendations for implementation of the prototype follow.

Performance Analysis

Performance analysis was a process of defining the results expected by the leadership community and the facilitator practices that could lead to achievement of those results. Current and desired facilitator results, practices, and attitudes were analyzed during this phase. Measurable results, critical performance and learning measures, achievable facilitator practices, and work environment factors and conditions that support or hinder performance were profiled. Prototype design began after performance objectives and the flow of information in the leadership facilitator community were identified. The results of analysis were used to guide the planning for the evaluation, design and implementation of the learning and performance environment solution.

Prototype Design and Re-design (Continuous Improvement)

Participatory design processes are effective in building stakeholder and user commitment to the success of application systems through their active participation in the analysis of requirements and the specification of the system design. For this project, each design iteration and improvement was based on discussions with key sponsors, stakeholders and potential users. Participants and designers collaborated to develop a potentially valuable product, identify possible product improvements, and generally provide one another with guidance in the ongoing design of the product.

During this concurrent design and evaluation process, interviews and focus groups were conducted during which visual prototypes clarified concepts that were being discussed. Initial prototypes were PowerPoint slides, which were transformed into a prototype web site using simple WYSIWYG web design tools. To assist in this transformation, members of the target audience provided initial feedback regarding the site look and feel, and overall concept. Following initial feedback, a "joint application design" meeting was held with sponsors (designers, project managers, directors) during which the first relatively primitive web-based site was reviewed live. The purpose of this meeting was to collect data to assist in design decision-making. This review followed a somewhat orderly process with a set of structured interview questions accompanying the review of each screen. A major goal of this design iteration was to ensure that the organizational learning and performance objectives of the site were addressed.

Following this meeting, revisions were made accordingly in order to prepare the site for usability testing / evaluation. The evaluation process included, but was not limited to, assessment of the aesthetic

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quality of the interface, and following redesign, assessment of the content, learning activities, and achievement of objectives.

The first level of evaluation was with facilitators at a large training unit with more than 100 facilitators. Upon familiarizing the facilitators with the basic goals of the site, they were provided the URL and asked to provide feedback (we have been requested to not release the results of these evaluation processes by the client).

Following this process, the evaluation processes listed below were also completed:

- Learner/Performer Evaluation - A survey was placed on the website to gather input from facilitators regarding their reactions to site content and learning activities, and suggestions for improvement. Users also had the opportunity to provide feedback on the site discussion board.

- Individual interviews with novice users were conducted to observe a typical user interaction and resolve any barriers to navigation and learning. The user went through each activity and made suggestions for the content and layout of the site.

Specific strategies and recommendations related to utilization and ongoing support of the prototype that was designed and delivered to the client were proposed. These strategies and recommendations were focused in two key areas: 1) Adopting and diffusing the product within the target organization; and 2) Continuously improving the design and usefulness of the current prototype once it has been adopted by the target organization.

Adopting and Diffusing the Product: Implementation Strategies

The most well designed products often go unused or unappreciated within organizations often due to the lack of sponsorship and inadequate attention to the diffusion of the new technology. During the performance analysis phase of this project, many non-training, work environment factors that could contribute to the success or failure of the web-based learning environment were identified. Critical diffusion and work environment factors are identified below to highlight some of the biggest challenges to project success with this particular target audience. Recommendations relative to these factors have also been included.

Redefining/Restructuring, and Clarifying Relationships/Roles

These two critical stages in the diffusion of a technology within an organization have been documented by researchers in many different organizational settings (Rogers, 1995). Following initial design, development and evaluation of the web-based learning environment, it was expected that members of the facilitator community will begin the process of redefining/restructuring and clarifying roles related to this technology. Also see *Communities of Practice* by Wenger (1998).

The following recommendations were put forth in an effort to assist in the initial adoption, and redefining/clarifying of the prototype. Long-term evaluation of the site is possible only after adoption and utilization of the prototype by members of the facilitator community.

Recommendations:

- Identify decision-makers that will advocate the site. This is the identification of key stakeholders within the facilitator community who take responsibility for the product. The project sponsor and individual training units will be responsible for identifying key adopters, change agents, and problem-solvers who will champion the use of this innovation by members of the facilitator community. These role players will be active participants in the design, re-design, and evaluation of the application.

- Identify implementation managers who will diffuse the site throughout the facilitator community. This is a critical aspect of the early design and development of any new product. These are early adopters that must assume the burden of "selling" the product to others, as well as taking on much of the responsibility for its success. One strategy that stakeholders may use is to integrate this tool with other performance support tools currently in use.
- Introduce the site during ongoing activities already existing in the environment.
  - Introduce the site during initial mentoring.
  - Have trainers and mentors introduce the site as a tool for individual and job development The site could help experienced facilitators mentor and coach less experienced facilitators. Facilitators may be positively influenced to use the site if it is encouraged by their mentors as a useful way to develop skills and build new knowledge.
  - Introduce the site as part of facilitator training. Introducing the site as a tool that can be used by facilitators to build knowledge and skills related to job duties and responsibilities will increase its potential impact and overall effectiveness.

Resources for ongoing design and development

Identification of adequate resources, human and financial, to support the maintenance and continued growth of the application is crucial to success. This is an often-neglected aspect of computer-based application development, especially if the technology requires frequent updating. Web-based technologies are easier to update than other technologies and thus represent a potential long term cost savings.

Recommendations:

- Form a team responsible for learning and redefining the website. Although time and monetary requirements are minimal, it will be essential to identify key personnel who will be responsible for supporting ongoing maintenance of the site. It was suggested that internal facilitators who are familiar with the facilitator community and current practices be trained in change and redesign processes. A technical support resource responsible for updating and refining software and hardware will also be required for continual improvement of the site.
- Conduct prototype review groups with potential users and opinion leaders. Continual feedback from the learning community is helpful in redefining and redesigning the site to support and build on current course content.

Incentives

Incentives and reward systems are one of the least understood yet most effective methods of improving performance in the workplace. The benefits of participating in the learning environment include improved performance, self-development, and professional growth.

Recommendations:

- Official "release" time for participation in learning activities, and recognition for participation are highly recommended. The costs of release time can be considerable but the potential benefits of participation, in terms of improved performance, are well worth the cost.
- Facilitators should receive positive consequences and encouragement from their command to use the site as part of their ongoing skill development.

Process Management

Technical and human resource management will be required to ensure consistent, supportive, and performance-oriented system implementation. The interrelationship of this new process with other facilitator processes is part of the role of project leaders.

Recommendations:

- Leaders of this project within the facilitator community must be fully engaged in the process of creating, refining, communicating and using knowledge that is supported by technology.

- Periodic feedback should be elicited from facilitators to continually improve and add areas of interest to facilitators that are actually using the site.

Equipment (see *Site Technical Maintenance* section)

Hardware and software, physical information infrastructure, and documentation will be required to support initial and ongoing system development.

Recommendations:

- Current computer hardware and software must meet minimum specifications in order to capitalize on emerging technologies. This is probably the most expensive (monetarily) of all implementation factors, but can pay off in learning and performance effectiveness in the long term.

Continuous Improvement of the Learning and Performance Environment

The following section lists the major components of the web-mediated learning and performance environment. These components address the learning objectives required to achieve selected facilitator performance requirements or best practices. By addressing the best practices that were identified through the performance analysis, this learning environment has a greater likelihood of having a positive impact on facilitator, performer, and organization readiness. The pages that follow offer a brief description of each component of the learning and performance environment, and recommendations for continuous improvement and maintenance of each component on the website. Many of the recommendations included here were generated during the participatory design processes.

Learning Environment Component: Practice

Purpose: To enhance content knowledge and problem solving ability in the area of motivation through a variety of Self-Assessment/ Content Mastery activities.

These activities include multiple choice, matching and "essay"/case study response formats in an effort to enhance situational problem- solving ability.

Recommendations for Ongoing Development:

- Monitor and update self-assessment items to reflect current course content.
- Continually develop new items that challenge users and reflect current research and practice in the area of motivation.
- Ensure relevant, corrective feedback for each item.
- Add tutorials that provide a review of classroom material for each level of the course guides for motivation.
- Identify current problems to which facilitators can apply basic problem solving skills to solve larger issues/concerns.
- Monitor case study submissions to ensure learning opportunities go beyond that presented in the classroom.
- Continually add new case studies. 'Expert' facilitators could be identified to update and maintain relevant case studies.
- Review submissions by peers and revise as necessary.
- Revise case studies as field experiences change or as current case studies become outdated.
- Hold expert forums in the chat room and/ or archive interview transcripts.

Learning Environment Component: Discussion Board

Purpose: To provide current learners with a platform to build usable knowledge for current and future facilitators and leaders through interaction.

Features include: Message Board with chat feature to share ideas, experiences, discussions, etc., and Synchronous and Asynchronous communication options.

Recommendations for Ongoing Development:

Cleaning up/Monitoring

- Continually monitor information for accuracy.
- Delete outdated or incorrect information.
- Review other discussion boards that may better suit user requirements (see *Site Technical Maintenance* section).

Maintaining Interactions

- Periodically post new discussion topics.
- Encourage participation by "graduates" now on the job.
- Provide positive consequences for facilitators to interact with others on the discussion board.
- Reward expert facilitators or SME's who participate in scheduled discussions.

Learning Environment Component: Help

Purpose: To provide assistance and reduce frustration in navigating through the site. Features include a Site Map, Technical Help with FAQ's and site tips.

Recommendations for Ongoing Development:

Updating/Revising

- As facilitators become more familiar with the site, Help section will require frequent review/revision.
- Monitor and delete/update FAQ's. Facilitators should be encouraged to ask questions of their peers and to respond to questions appropriately.
- Revise site map/navigational tips based on revisions and advancements to the site.

Learning Environment Component: Knowledge Base

Purpose: Where all other features converge to allow for storage of objective (known facts, theories, procedures) knowledge and to promote constructed (new) knowledge.

Features include: Library with motivation-related readings, instructional resources, and links to other organization web sites.

Recommendations for Ongoing Development:

- *Monitor and update/ delete "dead links" to remain current. Many online resources are deleted by the site authors after a certain period of time and therefore many links may become "dead" links.*
- *Links should reflect current course content and should not present views conflicting with current curriculum.*
- *Expert contributions should be archived and continuously updated.*
- *Archived models/theories should be created and easily accessed.*
- *A drop-down menu can be created so that reactions to information found in web links can be accessed under each link in the Library.*

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Learning Environment Component: Evaluation

Purpose: To provide an opportunity for the user to aid in the continual development of the site.

Users complete a profile that identifies them by location and level experience, among other factors, and solicits their feedback on the site. This profile is also suitable as a Level One (Kirkpatrick) reaction evaluation tool.

Recommendations for Ongoing Development:

- *Evaluation responses should be logged and continuously monitored to assist in usefulness of data in continuous site improvement.*
- *Survey questions (as well as the profile) should be reviewed based on changes to the site and evaluation data expected.*
- *As updates are made to the site, face-to-face evaluations should be conducted in order to observe interactions and to receive feedback from facilitators regarding ease of navigation and usefulness of activities.*

Site Technical Maintenance

The following is a brief description of the tools and applications used in the development of this project. The designers provided sufficient information for an Information Technologist to understand the basic architecture and technical features of this product for the purpose of continual technical development. Where applicable, possible alternative applications to the ones used in the prototype design were suggested.

Platform: Windows NT 4 running on Novell Network Server.

- *Maintenance Suggestions:* All site HTML and graphic files should be transferred to a Navy server for ease and control of ongoing site maintenance.

Web Interface: The site is optimized to run on MS Internet Explorer and/or Netscape Navigator browsers.

Development Applications:

Microsoft FrontPage 2000™

Macromedia Fireworks 3™

Hypertext Markup Language (HTML)

Macromedia Flash 4™

Notepad

Microsoft Access 2000™

Adobe Photoshop 5.5™

Visual Basic Scripting™

Web Crossing™

There are various online course development software applications that have also gained popularity. WebCT, Blackboard CourseInfo, Phoenix Pathlore, and Construe are just a few examples. Alternatively, this site was created with a variety of COTS products that allowed design flexibility for ultimate user customization.

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